

REMARKS

I. Status of Claims

Claims 1-4, 6-14 and 16-23 are pending in this application, the independent claims being claims 1, 11 and 23. By this Amendment, claims 5 and 15 are canceled, claims 1, 3, 10, 11, 13 and 20 are amended, and claims 21-23 are newly presented.

II. Summary of Official Action

In the Action, the drawings were objected to as not showing a claimed feature of "mirror symmetry of the piezoelectric unit in a lamination direction." Independent claims 1 and 11 were objected for the same reason. Claims 1-7 and 11-17 were rejected under 35 U.S.C. §102(b), as anticipated by U.S. Patent No. 5,266,964 (Takahashi), and claims 8-10 and 18-20 variously were rejected under 35 U.S.C. §103(a), as unpatentable over the Takahashi '964 patent in view of either U.S. Patent No. 6,416,172 (Jeong) or U.S. Patent No. 6,478,412 (Hanabata). Reconsideration and withdrawal of the objections and rejections respectfully are requested in view of the above amendments and the following remarks.

III. Formal Objections

The objection to the drawings and the formal objection/rejection of independent claims 1 and 11 respectfully are traversed. Support for the feature of a laminate (or multilayer sheet) including a plurality of piezoelectric layers and a plurality of common electrodes, the plurality of piezoelectric layers and the plurality of common electrodes being arranged such that an upper half of the laminate and a lower half of the laminate are substantially mirror symmetric in a lamination direction may be found in the original application, e.g., in Figs. 6 and 7 and the corresponding description at paragraph [0070].

In this regard, however, independent claims 1 and 11 have been amended to improve their form, to recite more clearly this feature of the claimed invention. No new matter has been added.

Reconsideration and withdrawal of the formal objection/rejection respectfully are requested.

IV. Claim Amendments

Without conceding the propriety of the rejections, and solely to advance prosecution of the present application to issue, claims 5 and 15 are canceled herein without prejudice to or disclaimer of the subject matter recited therein. The features previously recited in claims 5 and 15 have been incorporated into independent claims 1 and 11, respectively. No new matter has been added.

V. Claimed Invention

The rejections of claims 1-4, 6-14 and 16-20 over the cited art respectfully are traversed. Nevertheless, without conceding the propriety of the rejections, and solely to advance prosecution of the application to issue, independent claims 1 and 11 have been amended to recite more clearly various novel features of the claimed invention. No new matter has been added.

The present invention relates to a novel inkjet head and piezoelectric actuator 4 and inkjet head. In one aspect, as now recited in independent claim 1, the inkjet head comprises a cavity unit having a plurality of ink pressure chambers formed at a regular interval; and a piezoelectric unit stacked on the cavity unit to close openings of the ink pressure chambers. The piezoelectric unit includes a laminate and a plurality of driving electrodes. The laminate includes a plurality of piezoelectric layers and a plurality of common electrodes, each common electrode extending substantially over the whole area defined between adjacent piezoelectric layers sandwiching the common electrode. The plurality of piezoelectric layers and said plurality of common electrodes are arranged such that an upper half of the laminate and a lower half of the laminate are substantially mirror symmetric in a lamination direction,

and the plurality of driving electrodes formed on a top face of the laminate at positions corresponding to respective ones of the ink pressure chambers.

In another aspect, as now recited in independent claim 11, a piezoelectric actuator for an inkjet head comprises a multilayer sheet including a plurality of piezoelectric layers and a plurality of common electrodes. Each common electrode extends substantially over the whole area defined between adjacent piezoelectric layers sandwiching the common electrode. The plurality of piezoelectric layers and the plurality of common electrodes are arranged such that an upper half of the multilayer sheet and a lower half of the multilayer sheet are substantially mirror symmetric in a lamination direction. A plurality of driving electrodes are formed on an outer surface of the multilayer sheet.

VI. Prior Art Distinguished

Applicants submit that the prior art fails to anticipate the claimed invention. Moreover, Applicants submit that there are differences between the subject matter sought to be patented and the prior art, such that the subject matter taken as a whole would not have been obvious to one of ordinary skill in the art at the time the invention was made.

The Takahashi '964 patent relates to a piezoelectric inkjet printer head, and discloses an inkjet printer head including a cavity unit having a plurality of ink pressure chambers formed at regular intervals, and a piezoelectric unit stacked on the cavity unit to close openings of the ink pressure chambers, the piezoelectric unit including a laminate and a plurality of driving electrodes, the laminate including a plurality of piezoelectric layers and a plurality of common electrodes. However, Applicants submit that the Takahashi '964 patent fails to disclose or suggest at least the above described features of the present invention. In particular, the Takahashi '964 patent fails to disclose or suggest at least the feature of a laminate/multilayer sheet including a plurality of piezoelectric layers and a plurality of common electrodes, each common electrode extending substantially over the whole area

defined between adjacent piezoelectric layers sandwiching the common electrode; nor does the Takahashi '964 disclose the feature wherein the plurality of piezoelectric layers and the plurality of common electrodes are arranged such that an upper half of the laminate (or multilayer sheet) and a lower half of the laminate are substantially mirror symmetric in a lamination direction, as disclosed and claimed in the present application.

Moreover, Applicants submit that, if possible at all, it would not be obvious to modify the Takahashi '964 patent to include such features. The Takahashi '964 patent discloses a shear-mode piezoelectric actuator that requires driving electrodes and common electrodes be arranged on the same surface/interface defined between two piezoelectric layers.

Accordingly, Applicants submit that the Takahashi '964 laminate/multilayer sheet may not be modified to include the feature where "each common electrode extends substantially over the whole area defined between adjacent piezoelectric layers sandwiching the common electrode" as disclosed and claimed in the present application.

The Jeong '172 patent relates to an ink-jet head device with a multi-stacked PZT actuator, and was cited for its disclosure of a conductive pattern formed on the surface of a piezoelectric unit to electrically connect a plurality of common electrodes at their exposed surfaces, and a surface electrode formed on a peripheral area on the top face to extend the conductive pattern. Without conceding the propriety of the Examiner's characterization of the Jeong '172 patent structure, Applicants submit that the Jeong '172 patent fails to disclose or suggest at least the above-described laminate/multilayer sheet features of the present invention. Nor is the Jeong '172 patent believed to add anything to the Takahashi '964 patent that would make obvious the claimed invention.

The Hanabata '412 patent relates to a piezoelectric thin film device, its production method, and an ink-jet recording head, and was cited for its disclosure of a piezoelectric unit having a substantially trapezoidal form. Without conceding the propriety of the Examiner's

characterization, Applicants submit that the Hanabata '412 patent fails to disclose or suggest at least the above-described laminate/multilayer sheet features of the present invention. Nor is the Hanabata '412 patent believed to add anything to the Takahashi '964 patent and/or the Jeong '172 patent that would make obvious the claimed invention. In this regard, Applicants understand the Hanabata '412 patent to relate to a piezoelectric thin film element having an inverse trapezoidal cross-section; claims 10 and 20 are directed to a piezoelectric unit having a substantially trapezoidal planar form.

For the above reasons, Applicants submit that claims 1 and 11 are allowable over the cited art.

Claims 2-4, 6-10, 12-14 and 16-20 depend from claims 1 and 11, respectively, and are believed allowable for the same reasons. Moreover, each of these dependent claims recites additional features in combination with their respective independent claim, and is believed allowable in its own right. Individual consideration of the dependent claims respectfully is requested.

VII. Newly Presented Claims

Newly presented claims 21-23 have been added to provide Applicants with an additional scope of protection commensurate with the disclosure. No new matter has been added.

In another aspect of the claimed invention, as recited in newly presented independent claim 23, an inkjet head comprises a cavity unit having a plurality of ink pressure chambers formed at a regular interval, and a piezoelectric unit stacked on the cavity unit to close openings of the ink pressure chambers. The piezoelectric unit includes a laminate and a plurality of driving electrodes. The laminate includes a plurality of piezoelectric layers and a plurality of common electrodes, with each common electrode extending over a plurality of ink pressure chambers. The plurality of piezoelectric layers and the plurality of common

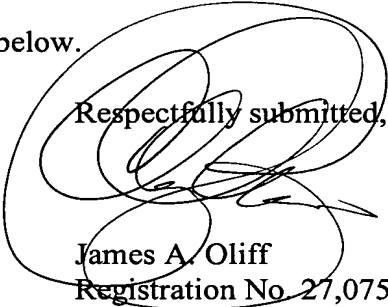
electrodes are arranged such that an upper half of the laminate and a lower half of the laminate are substantially mirror symmetric in a lamination direction. The plurality of driving electrodes are formed on a top face of the laminate at positions corresponding to respective ones of the pressure chambers.

VIII. Conclusion

Applicants believe the present Amendment is responsive to each of the points raised by the Examiner in the Official Action, and respectfully submit that this application is in condition for allowance. Favorable consideration of the claims and passage to issue of the present application at the Examiner's earliest convenience earnestly are solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,


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Attachments:

Petition for Extension of Time
Amendment Transmittal

Date: June 24, 2005

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